PROCEEDINGS OF THE
ROYAL ENTOMOLOGICAL SOCIETY
OF LONDON
SERIES C. JOURNAL OF MEETINGS

VOLUME 9. No. 10, 1945.

Report of the Council, 1944.

The difficulties of the times referred to by the Council in the report for 1943 have not lessened during the past year. On three occasions, 18 February, 5 July and 11 July, the Society's house suffered damage from enemy action, but fortunately on none was this serious. Essential repairs were quickly carried out, and the premises rendered wind and weather proof.

During the year the Council suffered the loss of one of its members by the death on 18 September 1944 of Mr. S. R. Ashby. His seat on the Council was filled by the co-option of Dr. H. E. Hinton. Early in the year Mr. Edelsten was nominated as the Society's representative on the National Trust for 1944 in place of Mr. Sheldon, who died in December 1943; and Dr. W. H. Thorpe was later nominated as the Society's representative on the Council for the Promotion of Field Studies.

In the course of the year Council had brought to its notice two instances of proposed action that threatened localities of entomological interest, but was able to satisfy itself in respect of both areas, Hell Coppice and Ailsworth Heath, that the position was, in fact, largely or entirely safeguarded. It has also continued to keep in touch with the work of the Hampshire War Agricultural Executive Committee in the New Forest.

The progress of the war has enabled the Society to re-establish contact with its elder sister, the Société entomologique de France, and with a small number of French entomologists. While it has so far not been possible to resume exchanges of publications with any of the liberated countries, efforts are being made to do so with the help of the British Council.

The upward trend in the attendance at General Meetings recorded last year has continued in a most gratifying way, the average attendance of Fellows and Visitors at the nine meetings having risen from 39 in 1943 to 49 in 1944. The full programmes arranged for all the General Meetings may largely account for this.

Much of the detailed business of the Society has, as hitherto, been controlled by the Finance Committee under the Chairmanship of Mr. Francis Hemming, and the Publication and Library Committee under the Chairmanship of Mr. C. T. Gimingham. The thanks of the Council are again due to the Fellows who have served on these committees.

The Library during 1944 has been much more freely used, both the numbers of Fellows borrowing books, 440 (343) [1] and the number of books borrowed,

[1] The numbers in brackets throughout the Report indicate the corresponding figures for the previous year.

740 (589) showing very substantial increases. The extent to which the Society's own books, and those of the many Societies who so freely co-operate in the lending of books, have been evacuated to the country, has entailed far more labour and correspondence than would be necessary in peace time, and the results reflect great credit on the Society's staff. To the National Central Library 14 (11) books were also lent during the year.

No damage has been reported to those parts of the Library which were sent out of London for safe keeping. One change in location has been made due to the absence of Dr. J. MacLeod on war service. The books formerly in his charge were removed from King's Langley to the Zoological Museum, Tring, where they are now in the care of Mr. Benson. The Council records its thanks to Dr. MacLeod for caring for the books since 1941.

The standard of the Society's publications has been maintained during the year in the face of increasing difficulty in the supply of materials, the increased cost of printing and particularly delays due to the printers' labour shortage. It is unfortunate that for the first time for many years it was not possible to issue the December part of the *Transactions* before the end of the year.

The volume for 1944 (Volume 94) contains 9 papers, of which 5 deal with Lepidoptera, 3 with Coleoptera, and 1 with Diptera. The volume consists of 355 pages and is illustrated by 85 plates. Very welcome assistance has been received from the Royal Society through whom £250 was received from the Rockefeller Gift in aid of scientific publications. £115 from the Egyptian Education Office on behalf of the paper by Dr. A. A. G. Hassan, and £50 from the E. B. Poulton Fund on behalf of the paper by Professor G. D. Hale Carpenter and Dr. B. M. Hobby, were further welcome contributions.

The *Proceedings* were continued, with some difficulty, in 3 series, as follows :

Series A. General Entomology. Volume 19 consists of 143 pages, and contains 26 papers.

Series B. Taxonomic Entomology. Volume 13 consists of 150 pages, and contains 33 papers.

Series C. Journal of Meetings. A part of *Series C* was sent to each Fellow in advance of meetings, and a complete copy of the volume will be distributed with the last part.

No part of the *Generic Names of British Insects* was published during the year, but Mr. Tottenham's report on the STAPHYLINIDAE is in an advanced state, and it is hoped that it will be published in 1945.

During the year the death of M. René Oberthür, an Honorary Fellow, and the Senior Fellow of the Society, which he joined in 1877, and of 14 (10) Fellows has been reported : S. R. Ashby, A. H. Bennett, G. T. Bethune-Baker, G. A. Bissett, W. Buckley, M. G. M. Browne, T. H. Edmonds, W. Falconer, J. Forsyth Johnstone, B. Lloyd, H. M. Peebles, Lady Robinson, K. St. Aubyn Rogers, and C. Rippon.

The following 4 (5) have resigned : G. E. Bryant, G. W. Nicholson, W. H. T. Tams, and B. Vesey-FitzGerald.

The following 3 (33) have been removed from the list of Fellows in accordance with the Bye-Laws, Chapter XVI, Section 3 : B. G. Adams, S. N. Chatterjee, and F. S. Parsons.

During the year 3 Special Life Fellows, Dr. K. G. Blair, Dr. A. D. Imms, F.R.S., and Mr. R. W. Lloyd, and 54 (44) Ordinary Fellows have been elected, of whom 47 fulfilled their obligations.

At 31 December last the Society consisted of 9 Honorary Fellows, 10

Special Life Fellows, and 681 Ordinary Fellows, a total of 700. As stated last year the Council decided to retain on the list of Fellows the names of certain Fellows who were more than two years in arrear with their subscriptions because of the impossibility of communicating with them. To date 19 such Fellows remain on the list, and this number is included in the total of 700 given above. Nevertheless it is gratifying to record the return after six years to a total Fellowship of 700.

No application for the loan of the Eltringham Microscope was made during the year, and it was not lent. The Council hopes that interested Fellows will remember that the instrument is available for loan at the discretion of the Council to Fellows and others engaged in entomological research upon application to the Secretary.

The Society's premises have continued to be used as the Publication Office of the International Commission on Zoological Nomenclature and as the offices of the Society for the Bibliography of Natural History. The latter body has remained dormant, but the resumed activities of the former have so increased that it was no longer possible for the Society's staff to take them in its stride, and other arrangements had to be made, which, however, do not affect the provision of accommodation and facilities as heretofore.

Treasurer's Report.

Mr. Welti said :—

When I say that I am happy in presenting to you the Accounts for 1944, it will be realised that, despite the adverse times, they are favourable.

The Accounts, which have been audited by Messrs. W. B. Keen & Co., actually show a Credit Balance of £30 6*s*. against £22 estimated in the Budget. In the past year the Society's financial position has benefited once more by the saving of the Registrar's salary, as he has continued to be on Government Service. In consequence it has been possible to make some provision in the accounts for future liabilities.

One day our premises will have to be redecorated and in the course of years it may become imperative to make some major alterations and improvements. Funds will be required for this and an additional sum has now been set aside for this eventuality.

In regard to our Library, you will agree on the importance of keeping it as up-to-date as possible. A sum of money has therefore been allocated for Binding, and the Purchase of Books, which are being published in other countries and which at the moment we are precluded from acquiring. Apart from this, it has been possible to earmark some funds for a new Library Catalogue. The last edition was issued in 1893 with a Supplement in 1900. While it may be some time before this task can be taken in hand, it is well to prepare by setting aside some of the cost while we are able to do so.

As you will see from the Accounts, the Staff Provident Fund has been replenished and increased by £80 plus some small contributions, which are gratefully acknowledged. The entire sum derived from Admission Fees (£131 5*s*.) has been placed to Capital Reserve Account in accordance with the precedent of the last few years.

Sales of Publications during the past year have exceeded expectations, which is very gratifying. Most of you will remember that in 1941 we received a legacy of £200 from Lieut. Wilkinson, R.N.V.R., towards the publication of his monograph of the genus *Apanteles*. At the time it was not clear how

the additional cost was to be defrayed and contributions were invited. There has been some response and I am glad of this opportunity of thanking the donors. The whole question of the publication of this work has been under consideration as it was not completed when Lieut. Wilkinson unfortunately fell an early victim in the war. At first it was intended to endeavour to complete the work, but on reflection it has been decided to publish the work as Lieut. Wilkinson left it. This may eventually be followed up by a revision or supplement. The Publication Committee has agreed on this course and the monograph will appear in the current year. Any cost beyond the legacy and donations will be paid from our usual Publication Funds.

I should like to express my best thanks to our President, our Hon. Secretary and the Finance Committee under the Chairmanship of Mr. Francis Hemming for all the help given during last year. I also have pleasure in recording my sincere thanks to Mr. Griffin, Miss Evans and Sergt. Campbell for all the assistance they have given. Without their aid it would have been impossible to carry through with the work and our Society is more than fortunate in having these helpers in the present times, for their heart is in their work and no effort is too great for them.

Committee for the Protection of British Insects.

The Hon. Secretary of the Committee for the Protection of British Insects reports that the list of entomological localities meriting preservation, proposed by the Committee in consultation with a number of entomologists, had been passed to the Nature Reserves Investigation Committee, under the Chairmanship of Sir Lawrence Chubb. It was understood that that Committee had now in preparation a report suggesting a number of areas that should be treated as National Nature Reserves. Such reserves, of course, had to be selected in relation to diverse natural history interests, and it was evident that many areas principally of interest from their entomological standpoint could not be included. There would, therefore, be a great need for entomologists to concern themselves actively with the preservation of additional areas, and it was hoped to take the matter up as soon as Sir Lawrence Chubb's Committee had reported.

Contributions were again made to the Wicken Fen Fund and to the protection of *Maculinea arion* in Cornwall. The Committee consider that before any further contributions are made towards the latter it will be necessary to inspect the area. No cutting or burning of the gorse has been possible since the war commenced, and it is not known if the butterfly still exists there, or has been swamped out.

The subscriptions to the Wicken Fen Fund amounted to £77 8*s*. 6*d*. (as against £70 17*s*. in 1943), postages and printing to £2 18*s*., leaving a balance of £74 10*s*. 6*d*., which has been paid to the National Trust.

The Protection Fund totalled £32 0*s*. 10*d*.; payments amounted to £19 3*s*., leaving a balance to be carried forward of £12 17*s*. 10*d*. (as against £14 4*s*. 4*d*. in 1943).

The late frosts and drought in May seriously checked the docks in both Wood Walton and Wicken Fens, consequently the Large Coppers suffered considerably, but it is hoped that sufficient stock remains to keep the colonies going.

The Committee has kept in touch with both the National Trust and the Society for the Promotion of Nature Reserves.

THE ROYAL ENTOMOLOGICAL SOCIETY OF LONDON.

STATEMENT OF INCOME AND EXPENDITURE for the Year ended 31 December, 1944.

(Presented at the Annual Meeting, 17 January, 1945.)

GENERAL FUND.

INCOME.

1943. £	£		£ s. d.	£ s. d.
		To subscriptions—		
	39	received in advance for 1944 ...	33 12 0	
	1,116	received in 1944 for 1944	1,191 12 2	
	70	received in 1944 for previous years ...	85 6 0	
	1,225		1,310 10 2	
	60	*less* subscriptions in arrear at 31 December, 1943—valued at ...	70 0 0	
	1,165		1,240 10 2	
	70	*add* subscriptions in arrear at 31 December, 1944—valued at ...	60 0 0	
1,235				1,300 10 2
231		,, transfer from Capital Reserve Fund— dividends on investments (gross) ...		237 15 10
		,, publications—		
	1,102	sales	1,205 10 11	
	255	transfer from library fund—value of exchanges	275 0 0	
1,357				1,480 10 11
21		,, interest on deposit		30 1 8
		,, sub-tenants—		
	250	rent	268 0 0	
	246	contribution towards house expenses	227 5 1	
496				495 5 1
		,, miscellaneous		—
£3,346				£3,544 3 8

EXPENDITURE.

1943. £	£		£ s. d.	£ s. d.
		By house expenses—		
	189	wages	196 5 2	
	74	fuel, gas and electric light	85 11 9	
	19	insurance	17 17 5	
	25	water	22 8 2	
	100	repairs fund—transfer	200 0 0	
		A.R.P.—		
	31	war damage insurance—contents	15 5 0	
	—	other expenditure	16 2 6	
	30	miscellaneous	27 0 8	
468				580 10 8
		,, office—		
	483	salaries	489 14 0	
	14	printing and stationery	30 6 11	
	61	postage and telephone	62 14 0	
	26	audit fee	26 5 0	
	25	superannuation	25 5 5	
	29	miscellaneous	37 8 6	
638				671 13 10
		,, library fund—		
	75	transfer	115 3 9	
	100	do. towards book purchases...	100 0 0	
	—	do. towards library catalogue	300 0 0	
	255	value of exchanges	275 0 0	
430				790 3 9
	1,633	,, publications	1,743 14 9	
	310	*less* donations ... 515 0 0		
	—	Westwood bequest 14 7 4		
	310		529 7 4	
	1,323			1,214 7 5
	150	,, transfer to special publications fund ...		—
1,473				
		,, donations—		
	25	*Zoological Record*	25 0 0	
	—	International Commission on Zoological Nomenclature	25 0 0	
	5	Wicken Fen Fund	5 0 0	
	2	Committee for the Protection of British Insects	2 2 0	
32				57 2 0
250		,, transfer to Staff Provident Fund ...		200 0 0
55		,, excess of income over expenditure carried to Balance Sheet		30 6 0
£3,346				£3,544 3 8

STATEMENT OF INCOME AND EXPENDITURE for the Year ended 31 December, 1944.

LIBRARY FUND.

Income.

1943. £	1943. £		£ s. d.	£ s. d.
		To interest on investment—		
44		Hamilton Druce Bequest Fund		43 16 6
		,, General Fund—		
	75	transfer	115 3 9	
	100	do. towards book purchases	100 0 0	
	—	do. library catalogue	300 0 0	
	255	do. value of exchanges	275 0 0	
430				790 3 9
£474				£834 0 3

Expenditure.

1943. £	1943. £		£ s. d.	£ s. d.
		By expenditure—		
	46	new books	32 6 3	
	73	binding, repairs and insurance	82 17 6	
119				115 3 9
255		,, transfer to sales of publications		275 0 0
100		,, excess of income over expenditure carried to Balance Sheet		443 16 6
£474				£834 0 3

REPAIRS TO PREMISES FUND.

Income.

1943. £		£ s. d.
—	To war damage compensation	24 19 5
100	,, General Fund—transfer	200 0 0
£100		£224 19 5

Expenditure.

1943. £		£ s. d.
—	By expenditure on repairs	26 3 3
100	,, excess of income over expenditure carried to Balance Sheet ...	198 16 2
£100		£224 19 5

SPECIAL PUBLICATIONS FUND.

Income.

1943. £		£ s. d.
48	To sales of "Generic Names of British Insects" and "Hübner" ...	13 5 11
150	,, transfer from General Fund	—
£198		£13 5 11

Expenditure.

1943. £		£ s. d.
176	By expenditure on "Generic Names of British Insects"	—
22	,, excess of income over expenditure carried to Balance Sheet ...	13 5 11
£198		£13 5 11

STAFF PROVIDENT FUND.

Income.

1943. £		£ s. d.	£ s. d.
—	To employees' contribution	10 0 0	
—	,, commission	19 16 4	
—	,, donation	5 0 0	
			34 16 4
250	,, General Fund—transfer		200 0 0
£250			£234 16 4

Expenditure.

1943. £		£ s. d.	£ s. d.
	By premiums on endowment policy—		
—	back service	100 0 0	
—	annual premium	20 0 0	
			120 0 0
250	,, excess of income over expenditure carried to Balance Sheet		114 16 4
£250			£234 16 4

BALANCE SHEET, 31 December, 1944.

GENERAL FUND.

LIABILITIES.

	£ s. d.	£ s. d.
To sundry creditors	1,221 2 1	
,, subscriptions in advance	56 14 4	
,, donations to publications unspent— Wilkinson Bequest	201 1 0	
		1,478 17 5
,, Westwood Bequest— as at 31 December, 1943	7 3 8	
add interest on investment during year	7 3 8	
	14 7 4	
less transfer to Income and Expenditure Account towards cost of plate	14 7 4	
		—
,, excess of assets over liabilities— as at 31 December, 1943	63 4 1	
add excess of income over expenditure for year to date	30 6 0	
		93 10 1
		£1,572 7 6

ASSETS.

	£ s. d.	£ s. d.
By sundry debtors—		
subscriptions valued at	60 0 0	
rent and contribution to house expenses	126 16 2	
publications valued at	425 0 0	
sundries	11 2	
		612 7 4
,, payments in advance		12 12 8
,, cash at bank and in hand—		
Current Account	827 19 6	
do. Petty Cash Account	112 1 5	
in hand	7 6 7	
		947 7 6
		£1,572 7 6

	£ s. d.	£ s. d.
Reconciliation of cash balances—		
Post Office Savings Bank—		
Library Fund	499 13 4	
Repairs to Premises Fund	426 17 8	
Special Publications Fund	233 14 10	
Staff Provident Fund	114 16 4	
		£1,275 2 2
Current Account—		
General Fund	827 19 6	
Library Fund	44 3 2	
	872 2 8	
less overdrawn—Capital Reserve Fund	24 7 3	
		£847 15 5
Petty Cash Bank Account—		
General Fund		£112 1 5
Cash in hand—		
General Fund		£7 6 7

LIBRARY FUND.

Liabilities.

	£ s. d.	£ s. d.
To excess of assets over liabilities—		
as at 31 December, 1943	300 0 0	
add excess of income over expenditure for year to date	443 16 6	743 16 6
		£743 16 6

Assets.

	£ s. d.	£ s. d.
By library furniture and fittings		(Not valued)
,, library books (valued at £10,000)		—
,, investment at cost—		
£200 3% Savings Bonds, 1955–65 ... ... (market value at date £202 0*s.* 0*d.*)		200 0 0
,, cash at bank—		
Post Office Savings Bank	499 13 4	
Current Account	44 3 2	543 16 6
		£743 16 6

REPAIRS TO PREMISES FUND.

Liabilities.

	£ s. d.	£ s. d.
To sundry creditors		9 3 0
,, excess of assets over liabilities—		
as at 31 December, 1943	568 18 6	
add excess of income over expenditure for year to date	198 16 2	767 14 8
		£776 17 8

Assets.

	£ s. d.
By investment at cost—	
£350 3% National Defence Bonds ... ... (market value at date £350 0*s.* 0*d.*)	350 0 0
,, cash at bank—	
Post Office Savings Bank	426 17 8
	£776 17 8

SPECIAL PUBLICATIONS FUND.

Liabilities.

	£ s. d.	£ s. d.
To excess of assets over liabilities—		
as at 31 December, 1943	622 17 1	
add excess of income over expenditure for year to date	13 5 11	636 3 0
		£636 3 0

Assets.

	£ s. d.
By investment at cost—	
£400 3% National Defence Bonds ... ... (market value at date £400 0*s.* 0*d.*)	400 0 0
,, sundry debtors for publications	2 8 2
,, cash at bank—	
Post Office Savings Bank	233 14 10
	£636 3 0

STAFF PROVIDENT FUND.

Liabilities.

	£ s. d.	£ s. d.
To excess of assets over liabilities—		
as at 31 December, 1943	250 0 0	
add excess of income over expenditure for year to date	114 16 4	364 16 4
		£364 16 4

Assets.

	£ s. d.
By investment at cost—	
£250 3% National Defence Bonds ... ... (market value at date £250 0*s.* 0*d.*)	250 0 0
,, cash at bank—	
Post Office Savings Bank	114 16 4
	£364 16 4

CAPITAL RESERVE FUND.

Liabilities.

	£	s.	d.	£	s.	d.
To excess of assets over liabilities—						
as at 31 December, 1943	6,033	6	3			
add admission fees received during year	131	5	0			
interest on investments	237	15	10			
	6,402	7	1			
less transfer to General Fund Income and Expenditure Account	237	15	10			
				6,164	11	3
,, cash at bank—overdrawn				24	7	3
				£6,188	18	6

Assets.

	£	s.	d.	£	s.	d.
By freehold premises, 41 Queen's Gate, S.W. ... ... (cost, including alterations, £13,417 3*s.* 4*d.*)				(Not valued)		
,, investments—						
at value at 6 March, 1934—						
£532 3*s.* 5*d.* 4% Consols	591	7	6			
at cost—						
£1,094 10*s.* 0*d.* 3% Conversion Loan	1,152	2	3			
£1,079 5*s.* 5*d.* 3% Funding Stock, 1959–69 ...	1,001	2	6			
£1,500 0*s.* 0*d.* 3% Redemption Stock, 1986–96 ...	1,331	0	3			
£593 17*s.* 0*d.* Mersey Docks and Harbour Board 3¼% Debenture Stock, 1970–80	498	8	6			
£600 0*s.* 0*d.* 3½% War Stock	609	2	0			
£1,000 0*s.* 0*d.* 3% War Stock	1,005	15	6			
				6,188	18	6
(market value at date, £6,537 5*s.* 2*d.*)						
				£6,188	18	6

TRUST FUNDS.

	£	s.	d.	£	s.	d.
To excess of assets over liabilities—						
as at 31 December, 1943—						
Hamilton Druce Bequest	1,000	0	0			
Westwood Bequest	250	0	0			
				1,250	0	0
				£1,250	0	0

	£	s.	d.	£	s.	d.
By investments at cost—						
£1,095 15*s.* 6*d.* New Zealand 4% Stock, 1943–63 ... (market value at date, £1,106 15*s.* 1*d.*)	1,000	0	0			
£239 12*s.* 4*d.* Birmingham Corporation 3% Stock, 1947	250	0	0			
				1,250	0	0
(market value at date, £226 8*s.* 4*d.*)						
				£1,250	0	0

(Signed) A. WELTI, *Hon. Treasurer.*

We have audited the above Balance Sheets and Accounts with the Books and Vouchers of the Society and certify them to be correct. The Solicitors have certified to us that they hold the Deeds of 41 Queen's Gate for safe custody on behalf of the Society, and we have verified the Investments and Bank Balances.

224, *Regent Street,*
London, W. 1.
15 *January*, 1945.

(Signed) W. B. KEEN & CO., *Chartered Accountants.*

WICKEN FEN FUND.

RECEIPTS AND PAYMENTS ACCOUNT for the Year ended 31 December, 1944.

Receipts.	£	s.	d.	Payments.	£	s.	d.
To donations	77	8	6	By printing, stationery and postage	2	18	0
				,, donation to the National Trust	74	10	6
	£77	8	6		£77	8	6

(Signed) H. M. Edelsten, *Hon. Treasurer.*

We have audited the above Account of Receipts and Payments and certify it to be correct.

224, *Regent Street,*
London, W. 1.
15 *January*, 1945.

(Signed) W. B. Keen & Co., *Chartered Accountants.*

COMMITTEE FOR THE PROTECTION OF BRITISH INSECTS.

RECEIPTS AND PAYMENTS ACCOUNT for the Year ended 31 December, 1944.

Receipts.	£	s.	d.	Payments.	£	s.	d.
To balance—1 January, 1944	14	0	4	By expenditure on preservation of *M. arion* and *L. dispar*	19	3	0
,, donations	18	0	6	,, balance at bank—31 December, 1944	12	17	10
	£32	0	10		£32	0	10

(Signed) H. M. Edelsten, *Hon. Treasurer.*

We have audited the above Account of Receipts and Payments and certify it to be correct.

224, *Regent Street,*
London, W. 1.
15 *January*, 1945.

(Signed) W. B. Keen & Co., *Chartered Accountants.*

THE PRESIDENT'S ADDRESS

YOU have learnt from the Report of the Council and the Treasurer's Report that the various activities of the Society and its prosperity have been maintained and, with a diminution in bombing during the winter months, the attendance at the meetings has improved. In spite of some narrow escapes the Society's house has suffered no serious damage and the contents of the library and the meeting room are intact. The Society's satisfactory position is largely due to the unremitting zeal of the Honorary Officers and to the work of the Registrar and his assistant. The Secretary and Treasurer, though the calls on their time have increased owing to the war, have given ungrudging attention to the affairs of the Society, and even during his serious illness the Treasurer continued to look after its interests. You will all be glad to welcome him on his return. I am deeply indebted to the Officers, members of the Council, and the general body of Fellows for the way in which they have supported me during my tenure of office.

One Honorary and fourteen ordinary Fellows have died during the year. I shall not attempt to give more than a brief account of those best known to me.

RENÉ OBERTHÜR, who became a Fellow in 1877 and was elected an honorary Fellow in 1931, died in April at the age of 92. He was an eminent coleopterist and possessed the finest private collection of beetles in Europe. Though he had as great a knowledge of entomology as his brother Charles, he published too little to achieve such world-wide recognition.

GEORGE T. BETHUNE-BAKER, son of Alfred Baker, F.R.C.S., was born in Birmingham on 20 July, 1857. Elected a Fellow in 1885, he was President in 1913–1914, Vice-President in 1910–1911 and 1915, a member of Council in 1895, 1910–1912, 1915, and 1919–1921, and served on many of the Committees. He took an active part in the local government of his native city, being at one time Chairman of the Education Committee, and in Church affairs. His chief entomological interest was in the LYCAENIDAE, and he published many valuable monographs and revisions of genera, notably those on *Arhopala*, *Tarucus*, *Lycaenesthes*, and *Catochrysops*. He was also interested in Heterocera and in 1926 described a new species from Spain, *Zygaena clorinda*. He was for many years Chairman of the Editorial Panel of the *Entomologist's Record*, and in this journal published papers on his visits to the continent. When his eyesight failed about 1928 he retired to Eastbourne, and gave his types to the British Museum and the rest of his collection to the University Museum, Cambridge.

SIDNEY R. ASHBY, born in May 1864, joined the Society in 1907, and was a member of the Council at the time of his death. For many years he was Curator of the South London Entomological and Natural History Society and completely rearranged its collections. He was an expert coleopterist, but, quiet and retiring, he contributed little to the literature.

THOMAS HERBERT EDMONDS, born in 1887, became a Fellow in 1927. He too was a coleopterist and added a number of species to the British list.

WILLIAM FALCONER joined the Society in 1919 and died in his eighty-first year. He had a wide knowledge of the Arachnida, and among his publications

are *The Evolution and Survival of the Spider*, *List of the Spiders of Yorkshire*, and *The Mites of Yorkshire*. He figured and described several spiders new to science and added others to the British list. He was an active member of the Yorkshire Naturalist's Union and became its President in 1927.

G. A. Bissett, who was elected a Fellow in 1936, became an Assistant Keeper at the British Museum, Natural History, in 1935. He was working on the Pyralidae, but when war broke out he was transferred to the Ministry of Agriculture. He was, however, eager to join the Forces, and as soon as an opportunity occurred he volunteered for the R.A.F., and after training in Canada, he obtained a Commission as an observer-navigator, but was lost on a mine-laying flight soon after having been posted to an operational squadron.

The other Fellows who died were W. Buckley, M. G. M. Browne, J. Forsyth Johnstone, Bertram Lloyd, H. M. Peebles, Claude Rippon, Lady Robinson, and the Rev. Canon K. St. Aubyn Rogers.

I am taking as the subject of my address

SOME OF THE CONTRIBUTIONS OF ENTOMOLOGY TO GENETICS

In the early days when the rediscovery of Mendel's work was comparatively new, Leonard Doncaster in 1906 did some breeding experiments with the moth *Abraxas grossulariata* and its aberration *lacticolor*, which led to one of the greatest genetical discoveries, sex-linkage. The first explanation of his results was complicated and required us to believe that every female *grossulariata* was heterozygous for the *lacticolor* factor, even in localities where no *lacticolor* were known to exist. The simple and correct interpretation was arrived at by correlating the results of breeding with cytological work on the chromosomes, and led to a clearer view of sex determination in most of the higher animals. Doncaster had already concluded that in this moth the male is homozygous and the female heterozygous for sex, and with the discovery that the male has two similar chromosomes XX and the female two dissimilar ones XY, it was a short step to decide that the *lacticolor* gene must lie in the X-chromosome.

The fact that all sex-linked characters in Lepidoptera and birds are transmitted by the male and affect the female, whereas in Diptera and man the reverse is the case, showed that in the former groups the sex chromosomes are similar in the male and the female is heterogametic, while in the latter the male is the heterogametic sex. This remarkable but unexplained fact has been confirmed in the most convincing manner by breeding experiments and cytological examination in the fruit-fly *Drosophila*. Many years ago Haldane noticed that in certain hybrid mammals and insects the offspring were invariably of one sex and enunciated his law that this was the homogametic sex. At first no explanation was forthcoming, but Lepidoptera soon gave most valuable clues. It was noticed that in some crosses, such as that between *Lycia hirtaria* male and *Nyssia zonaria* female, the offspring were all male, but that in others, such as that between the male *Smerinthus ocellatus* and the female *Laothoë populi*, while the great majority of broods consisted of males only, broods occurred now and then in which there were a few intersexes with a mosaic of male and female characters. The explanation is that in the former case all the females are transformed into males, but in the latter case

the transformation is sometimes incomplete, and the reason for the transformation is that the valency of the X-chromosome differs in the parent species. The work of Goldschmidt with *Lymantria dispar* and that of Morgan, Bridges, and their co-workers with *Drosophila melanogaster* has clearly proved that in these species, and by inference in others too, sex is determined by a balance between the X-chromosomes and the autosomes. In moths two sets of X to two sets of autosomes produce a male and one X to two sets of autosomes a female, but if the valency of the X is increased sufficiently without a corresponding change in the valency of the autosomes an intersex results. It is probable that the intersexual lice bred by Keilin and Nuttall (1919) by crossing the head and body louse are due to a difference in the valency of the X-chromosome in these biological races, and the very much smaller percentage of intersexes found in some strains of body lice by these workers and more recently by Musgrave may be due to intercrossing with head lice having taken place in some previous generation.

This view of sex determination has been confirmed by work on secondary hybrids in Lepidoptera, in which triploid intersexes have been produced and their triploid nature demonstrated cytologically. Triploid intersexes of *Drosophila melanogaster*, which possessed the second and third and sometimes the fourth chromosome in triplicate and the X-chromosome in duplicate, have been described by Bridges (1921). His surmise that they were triploids, based on their autosomal characters, was shown to be correct by cytological examination. Evidently genes in the autosomes of *Drosophila* tend to produce maleness and 2X to 3 sets of autosomes causes intersexuality, 1X to 2A being male and 2X to 2A being female.

But there are other causes of intersexuality. Sturtevant has shown that in *Drosophila simulans* there is a recessive autosomal gene, which in the homozygous state transforms females into males and renders males sterile, and Lebedéef has described a different type of intersex in *D. viridans*, which is also due to the action of an autosomal gene. Kosminsky has bred a type of intersex in *Lymantria dispar*, which differs from any of the intersexes due to unusual valencies of the X-chromosome or cytoplasm, and this is also due to the action of an autosomal gene. For such cases Goldschmidt suggests the term sex-intergrades, and they supply further evidence that the autosomes play as important a part in sex determination as the X-chromosomes.

Goldschmidt's work on the various races of *Lymantria dispar* has proved that in this species there are no less than eight grades of valency in the X-chromosome, behaving as allelomorphs, and various grades of valency in the cytoplasm. The X-chromosome exerts an influence in the direction of maleness and the cytoplasm and autosomes in the direction of femaleness. Unduly strong valency of the X-chromosome or unduly weak valency of the cytoplasm produces male intersexes, while unduly weak valency of the X-chromosome or unduly strong valency of the cytoplasm produces female intersexes. With a sufficient difference in their valencies, complete sex reversal may take place and a female may be transformed into a male or a male into a female. There is in addition an autosomal modifying gene T with an allelomorph t. The allelomorph t has a feminising influence and so in the homozygous state tends to produce male intersexes or to transform male intersexes into females, and with certain combinations it may even in the heterozygous state turn a male into a low-grade intersex. The work on *Lymantria* also led Goldschmidt to promulgate his Time Law, that the organs or parts of organs which are first to assume the characters of the opposite sex are those which

are the last to differentiate in embryonic life. As a corollary the time of incidence of the turning point towards the opposite sex is a measure of the degree of intersexuality, the earlier the turning point the higher the degree and the later the turning point the slighter the degree.

Further light has been thrown on the nature of sex by Morgan's experimental breeding of *Drosophila*. Gynandromorphs appeared in his cultures from time to time and in many cases the male parts showed a sex-linked recessive character, which was not present in the female parts. His explanation was that an X-chromosome was lost at the first or some subsequent division of the fertilised ovum, and it was actually shown cytologically that the male parts had a chromosome fewer than the female parts. This gave additional proof that sex is determined by the balance between X-chromosomes and autosomes. In Lepidoptera, as Doncaster has shown, gynandromorphs may arise in the same way, but this is quite exceptional. In this Order they usually originate from binucleate eggs and experimental breeding with *Argynnis paphia* and *Bombyx mori* has shown that the production of binucleate eggs is not a mere chance, but is determined by a recessive gene. Each nucleus is fertilised by a different spermatozoon, and if one nucleus is female-producing and the other male-producing, a gynandromorph results. In *Bombyx mori* by introducing into the strain characters such as translucent skin, which is recognisable in the larva, and winglessness in the female imago, Katsuki (1935) bred gynandromorphs, which could be detected in the larval stage and were more conspicuous in the imaginal. Examination of gynandromorphs of many species of Lepidoptera has shown that sometimes the male and female parts differ, one being normal and the other aberrational. In some cases breeding has proved that the aberrational form is autosomal, and in others this can be inferred from the fact that it is as frequent in the male as in the female sex. Such gynandromorphs could not occur through loss of an X-chromosome, and so many of them are known in various species that most gynandromorphs in Lepidoptera must originate from binucleate eggs.

Insects such as the honey-bee and certain other Hymenoptera produce females from fertilised eggs and males from unfertilised eggs, and, used by the Whitings for experimental purposes, *Habrobracon* in particular has been most valuable for the elucidation of some genetical problems.

The study of sex-controlled forms limited to the female sex, such as *Argynnis paphia* ab. *valesina*, the white females of *Colias philodice* and *C. croceus*, and the mimetic forms of *Papilio polytes*, *P. memnon*, and *P. dardanus* by Fryer, Gerould, and others has shown that they are all determined by a dominant autosomal gene, which has no effect on the colour or pattern of the male even in the homozygous state. Of the greatest interest is Fryer's work on *P. polytes*, because of the light it throws on the genetics of mimetic forms and on their evolution. *Parasemia plantaginis* has a form, ab. *hospita*, limited to the male sex, with white instead of yellow hind-wings, and this too is determined by a dominant autosomal gene.

Other examples of sex-limitation are due to non-disjunction, in which two X-chromosomes remain attached to one another and so pass on from generation to generation. The germ cells of the female are XX or Y, those of the male either X or Y, and the somatic cells are XXX, XXY, XY, and YY, of which only XXY and XY are viable. Proof of this has been obtained both by breeding and cytology in *Drosophila*, and it has thrown light on various genetic puzzles. For example, according to Haldane, it explains a remarkable human pedigree, in which all the women were colourblind and all the men normal, in spite of the

fact that colourblindness is a recessive sex-linked condition. In this family one-half of the children received from the mother two X-chromosomes united owing to non-disjunction and since both X-chromosomes carried the gene for colourblindness, these children were female and colourblind, the Y-chromosome received from the father producing no effect. The other half of the children received an X-chromosome from the father and a Y from the mother and were therefore males with normal vision.

A mutation may be defined as a transmissible change in the germ-plasm producing a detectable change in the characteristics of the individual. The change may be an increase or decrease in the number of whole chromosomes, for example triploidy or non-disjunction, or a chromosome aberration, such as duplication, the breaking off of part of a chromosome and its attachment to a homologous chromosome, translocation, breaking off with attachment to a non-homologous chromosome, or deletion, a break with loss of the broken part, or it may be a change at a single locus, a gene mutation. It is generally accepted that the chromosome consists of a protein fibre, not unlike that of silk, with active groups at intervals, which we call genes. Mutations of all these kinds occur under natural conditions, but their cause is still obscure. The commonest gene mutations occur with a frequency of about 1 in 300,000, but others occur much less often. The conception that a gene mutation is a change in the structure of one of the active groups of the protein fibre fits in with the fact that some mutations take place with greater frequency than others and that the same mutation occurs again and again at wide intervals of time and place. It also offers a reasonable explanation of how a mutation can be reversible. The first definite proof that a mutation can be reversible was obtained in the course of experiments with *Drosophila*. As a rule, when it is claimed that a gene has reverted to its original state, there is a possibility that the stock has been contaminated by the accidental introduction of the supposed mutant individual. Such was not the case in the carefully controlled experiments with *Drosophila*, for other characters were present in the mutant, which were also present in the rest of the culture. Nor does the evidence depend upon a single instance of reversion, for there are a number of undoubted instances of its occurrence and more than one gene has been shown to be reversible. White eye colour has mutated to eosin, and then back to white on more than one occasion, and subsequent breeding has shown that the new white was the same as the old. In a culture of *Drosophila funebris* homozygous for the factor " radius-incompletus " Timofeef-Ressovsky, after 24 generations of inbreeding, discovered a single normal fly, which proved to be heterozygous for the gene, and therefore could not have been introduced. It was a genuine instance of reversion to the wild type.

The first claim that a gene mutation had been produced by a definite external cause was put forward by Garrett and Harrison in their paper on induced melanism, the supposed cause being a salt of manganese in the food of certain Geometrid moths, notably *Selenia bilunaria*. For various reasons the claim failed to receive general acceptance, but there can be no doubt that X-rays and radium can cause mutations with considerable frequency. Much of this experimental work has been carried out on *Drosophila*. The mutations caused by radiation were for the most part already known and had occurred from time to time spontaneously in the course of ordinary breeding experiments. The majority were, however, pathological and were chromosome aberrations, but there were also a number of gene mutations, such as changes to the white eye colour. Radiation appears merely to speed up the normal

mutation rate. Interesting as the work is, it throws no light on the cause of mutation occurring under natural conditions.

Although it is obvious that closely allied species must have many genes in common, and indeed that this is the cause of their similarity, the fact is difficult to prove in animals. There is the difficulty of obtaining hybrids and the still greater difficulty of obtaining hybrids between parents of suitable genetic constitution. For to prove that a gene is identical, it must be present in both parents and preferably in the homozygous state. Crosses between *Drosophila melanogaster* and *D. simulans* are possible, many recessive mutations apparently producing the same effect are known in both, and flies homozygous for such factors are easy to breed. It is therefore possible to establish the identity of some genes in spite of the infertility of the hybrid. If a gene is really identical the hybrid will show the character, but, if it is similar but not identical, the hybrid will be normal and will not show the recessive character visible in both parents. This hybrid has been bred in very large numbers, and it has been found that the X-chromosome in both species is very similar and carries several identical genes at the same locus, but the autosomes are not so much alike, though they do carry some identical genes.

In Lepidoptera fertile hybrids are known, and in several cases direct breeding experiments have shown that perfect mendelian segregation occurs, and although this does not prove the identity of genes it shows that genes in both are allelomorphs. Bytinski-Salz and Gunther have found that the colour of the larval skin of *Celerio galii* and *C. euphorbiae* in the first instar is determined by two genes, those determining the black-green colour of *euphorbiae* being partially recessive to those determining the light green of *galii*. Larvae heterozygous for either of them, but not for both, are intermediate in colour. Harrison has found that mendelian segregation occurs in some hybrids of the genus *Poecilopsis* and in hybrid *Ectropis bistortata* and *E. crepuscularia*. In the latter the melanic dominant ab. *delamerensis* of *E. crepuscularia* and the melanic recessive ab. *defessaria* of *E. bistortata* were inherited independently and were not allelomorphic. Federley also proved that perfect segregation occurred in larval, pupal, and imaginal characters in back crosses and more complex crosses between *Pergesa elpenor* and *P. porcellus*, and he formulated the law that on the one hand conjugation of chromosomes, mendelian segregation, and fertility, and on the other hand lack of affinity of chromosomes, uniformity, and infertility go together.

Fisher in 1931 put forward the theory that when a new mutation occurs it very frequently shows partial dominance, the heterozygote being intermediate between the two homozygotes. As long as the mutant remains rare, nearly all examples occurring under natural conditions will be heterozygotes and will be subject to selection to a far greater extent than the homozygotes. If, as is usually the case, the new mutant is disadvantageous, modifying genes in other chromosomes will be selected and it will gradually become recessive, but, if it is advantageous, selection of the gene complex will tend to produce heterozygotes more and more like homozygotes and the mutant will become completely dominant.

Insects afford good examples of mutants, in which the heterozygotes are distinguishable from both homozygotes. One example is *Panaxia dominula* and its aberration *bimacula*, which has greatly increased black markings. The heterozygote, ab. *medionigra*, is intermediate, but it is very variable, and selective breeding has shown that it may approach either homozygote in appearance. The breeding in this case was rather haphazard and not carefully

controlled. Ford, however, in 1940 published the results of carefully conducted experiments with *Abraxas grossulariata* and its aberration *lutea*, which has a yellow ground colour, and gave the first experimental proof of Fisher's theory, using a wild form. Heterozygous *lutea* showed considerable variation and by selecting those most like normal *grossulariata* for one experiment and those most like homozygous *lutea* for the other and breeding from them, Ford obtained in the third generation heterozygotes indistinguishable from normal *grossulariata* in his first experiment and from homozygous *lutea* in his second. The original trimodal curve, with homozygous *grossulariata* and homozygous *lutea* at the ends and heterozygotes in the middle, became a bimodal curve either with homozygous *grossulariata* and heterozygotes or with heterozygotes and homozygous *lutea* merged. Thus he proved that *lutea* could be made either a recessive or a dominant character, and brought the change about by selection of the gene complex, which modified this unifactorial character in one or other direction. The homozygotes were modified at the same time but to a very much less degree.

This important piece of work has a direct bearing on genetics in general and on human genetics in particular. There are many harmful characters in man, which are unknown in the homozygous state, but are partially dominant. Some are more completely dominant than others, and even with the same condition it is not unusual to find dominance much greater in some families than in others. Both Fisher and Levit take the view that selection is so altering the gene complex that these semi-dominant characters are being changed into recessives, and that in the case of many harmful recessives the change has already been brought about. Moreover, it has been found that recessive genes, probably made so by selection of the gene complex, are very common in wild species of *Drosophila*, and in Lepidoptera they are not uncommon in *Abraxas grossulariata* and very numerous in *Arctia caia*.

Selection by modifying genes may carry the process a step further until even in the homozygous state a gene may fail to find expression and the phenomenon of imperfect penetrance is caused. The mutant " eyeless " of *Drosophila melanogaster* is very variable and the more complete the eyelessness the less the viability and the smaller the number of eggs laid. If, after obtaining a stock homozygous for eyelessness, the flies are allowed to breed promiscuously, the more eyeless and less fertile are at a disadvantage and eventually the homozygous flies become like wild flies with normal eyes. The gene complex selected in this way has suppressed the eyeless character. It was shown that no change had taken place in the gene itself, for on outcrossing with wild types a large number of eyeless flies appeared in the F2 generation.

Considerable light has been thrown on the relationship between hereditable and environmental factors by experiments with insects, and a number of mutants of *Drosophila* have been found which are modified by environment, although in most cases the nature of the environmental factor has not been fully investigated. Temperature and nutrition appear to be the most important agents. One of the best proofs that a condition with a genetic basis may need a particular environment before it can become manifest is reduplication of the legs in *Drosophila*. Hoge in 1915 showed that the reduplication, which follows Bateson's Law, rarely occurs when the larvae are kept at room temperature, but is almost invariably present when they are subjected to a temperature of 10° C. during an early stage of growth. Variability in the number of facets in the eye of bar-eyed *Drosophila* is also affected by tem-

perature during a short period of later larval life, an increase in the temperature decreasing the number of facets, their decrease being proportional to the increase in temperature. Kettlewell has recently shown that there is a gene in *Panaxia dominula*, the Scarlet Tiger Moth, which causes the white spots in the costal part of the fore-wing to disappear and reduces the size of the others, and at the same time causes the appearance of black along the costa of the hind-wing and increases the usual black markings. The gene is neither dominant nor recessive, for heterozygotes are intermediate in appearance. The character only became manifest when larvae and pupae were kept at a uniform temperature of 70° F., and that part of the brood, which was subjected to a fluctuating temperature, sometimes below and sometimes above 70° F., was quite normal.

In the case of another abnormality of *Drosophila*, broken or irregular bands on the abdomen, the amount of moisture in the food decides whether or no the gene produces any visible effect, for when the larvae are fed on dry food all the flies are normal. A still more interesting example is known in *Drosophila* through the researches of Gordon and Sang published in 1941. There is a gene, which prevents the development of the antennae under normal conditions of growth, but when the larvae are given an abundant supply of vitamin B2 the " antennaless " flies become indistinguishable from the wild type. The genetic differences in this case depend on the ability or inability to do something that is done by the molecule of vitamin B2, and thus the action of a specific gene has been equated with that of a specific vitamin.

The chromosome map of *Drosophila melanogaster* is one of the great achievements of genetics. The insect was admirably adapted for the purpose, for it has only four chromosomes, it can be bred in vast numbers on a standardised culture medium, and has a very large number of recognisable characters, both autosomal and sex-linked. Since chromosomes are as a rule handed on intact from parent to offspring, characters in the same chromosome will be handed down together, while those in different chromosomes will show no such linkage. Thus in *Drosophila* four groups of characters can be recognised, the genes for which lie in the four chromosomes. This merely shows in which chromosome certain genes lie, but gives no indication of their order or distance apart. This can only be determined by making use of the phenomenon known as crossing-over. Homologous chromosomes unite in pairs and usually separate again intact, but sometimes they become twisted round one another and break, so that portions become interchanged and with that interchange there is a transference of certain genes from one homologous chromosome to the other. The chance that such a crossing-over will occur between two given points depends on their distance apart and the greater the distance between them the more likelihood there is of a cross-over. The genes have a linear arrangement along the chromosome and their distance from one another can be calculated from the frequency with which crossing-over, *i.e.* a break between them, occurs. By calculating the percentage of crossing-over between different genes their positions along the chromosome can be determined after due allowance has been made for double crossing-over, and a diagram can be drawn showing the order of the genes and their approximate distance from one another in each of the four chromosomes. A very full map has been drawn for *D. melanogaster* and less complete ones for *D. simulans*, *D. willistoni*, *D. obscura*, and *D. virilis*. Similar chromosome maps may ultimately be made for other animals, but the much larger number of chromosomes and the difficulty of breeding them on the extensive scale required make this much

more difficult. Partial maps of single chromosomes have been made already, for instance Fisher has shown the order and approximate distance apart of four genes in the fowl, and a map of some of the genes in the fish *Lebistes* has been made. In man, with his 24 chromosomes, the difficulty is still further increased by the impossibility of experimental breeding, and apart from those in the X and Y chromosomes we do not know which genes are linked. Haldane, however, has published a map of that end of the X-chromosome in which the partially sex-linked characters lie.

If a chromosome map of man comparable with that of *Drosophila* is ever made, it may have far-reaching results, for it may then be possible to recognise those individuals in a family who are heterozygous for a recessive abnormality, and in the case of a semi-dominant condition, which does not manifest itself until adult life, it may be possible to forecast which members of a family will develop it.

Errata.

Vol. 10, p. 10, line 9 from foot, for "Dr. W. S." read "Mr. W. S."
Vol. 10, p. 10, line 8 from foot, delete "O.B.E."

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